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(54) **SECURITY SYSTEM WITH STAGING CAPABILITIES**

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See application file for complete search history.

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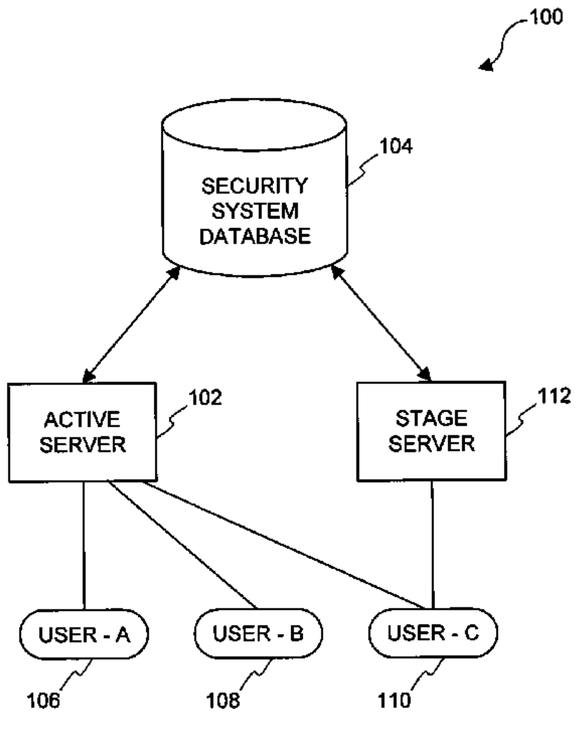
(57) **ABSTRACT**

An improved system and method for providing a security system with the capability to stage a modification to its operation is disclosed. Staging the modification before actually modifying normal operation of the security system allows the impact of the modification on the security system to be examined prior to deployment. If the staging of the modification to the security system is deemed successful, the modification can be fully deployed with reduced risk of unexpected security lapses or other detrimental consequences.

30 Claims, 9 Drawing Sheets



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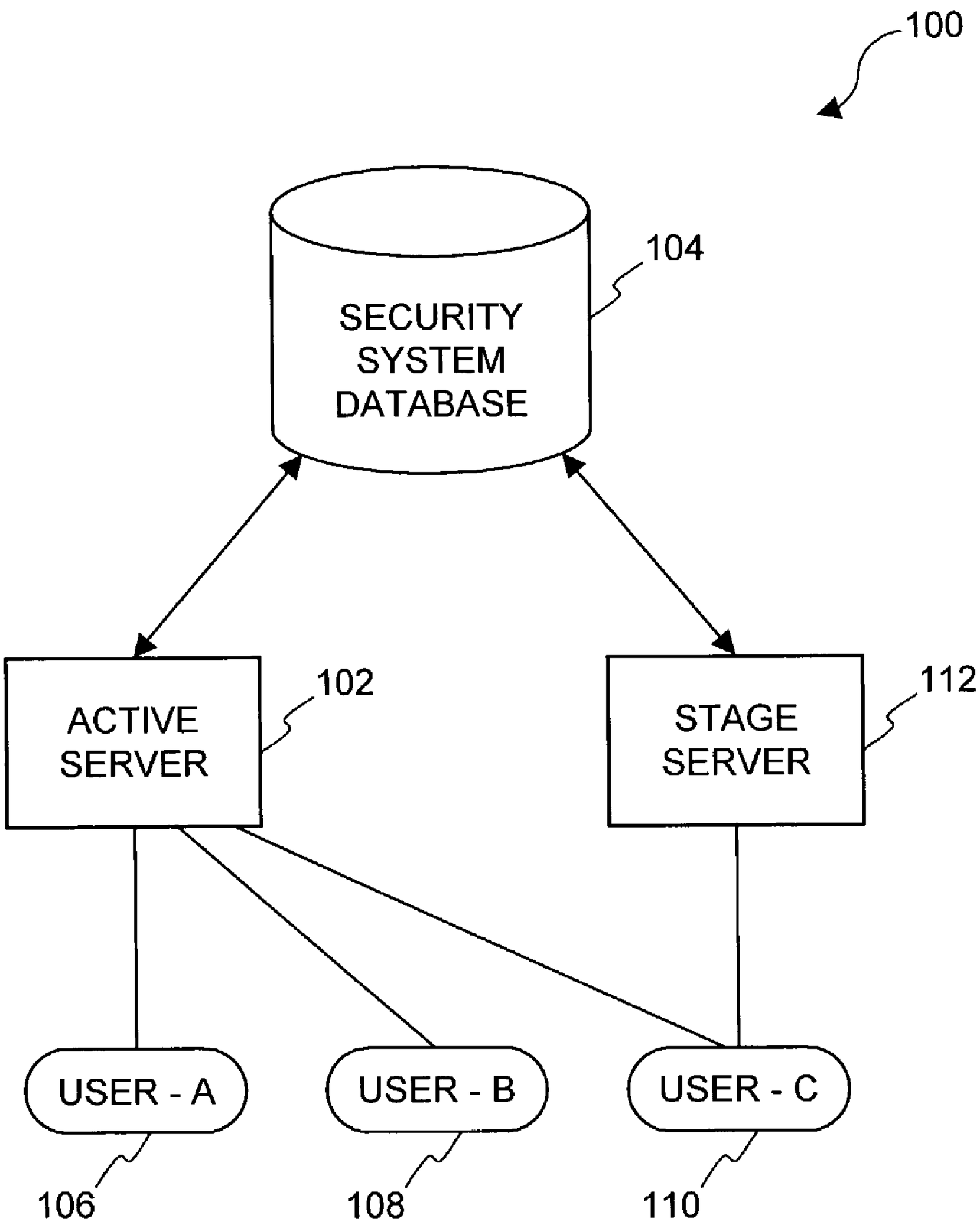
100
SECURITY SYSTEM DATABASE
104
ACTIVE SERVER
102
STAGE SERVER
112
USER - A
USER - B
USER - C
106
108
110

FIG. 1

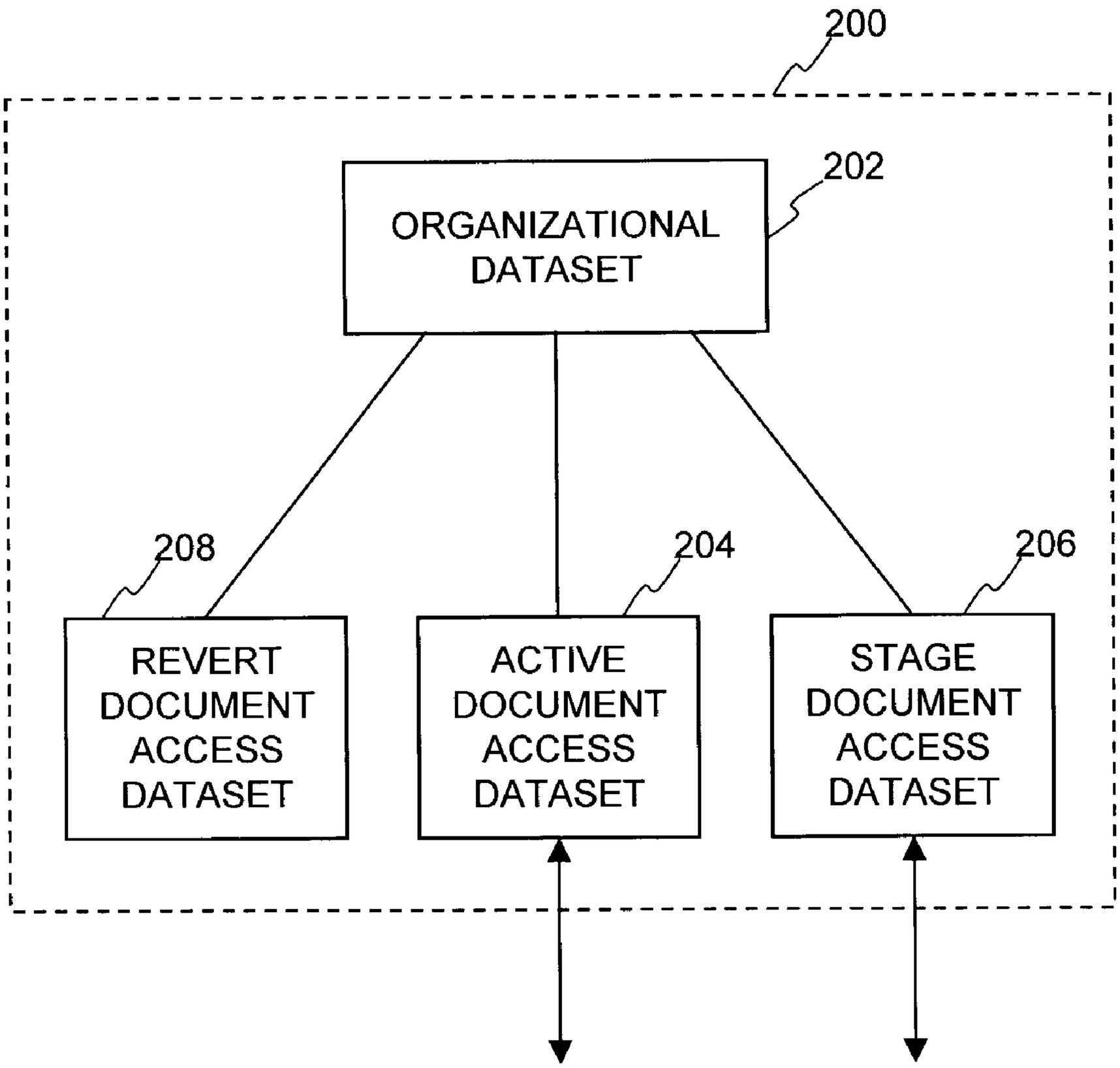
200
202
ORGANIZATIONAL DATASET
208
204
206
REVERT DOCUMENT ACCESS DATASET
ACTIVE DOCUMENT ACCESS DATASET
STAGE DOCUMENT ACCESS DATASET

FIG. 2A

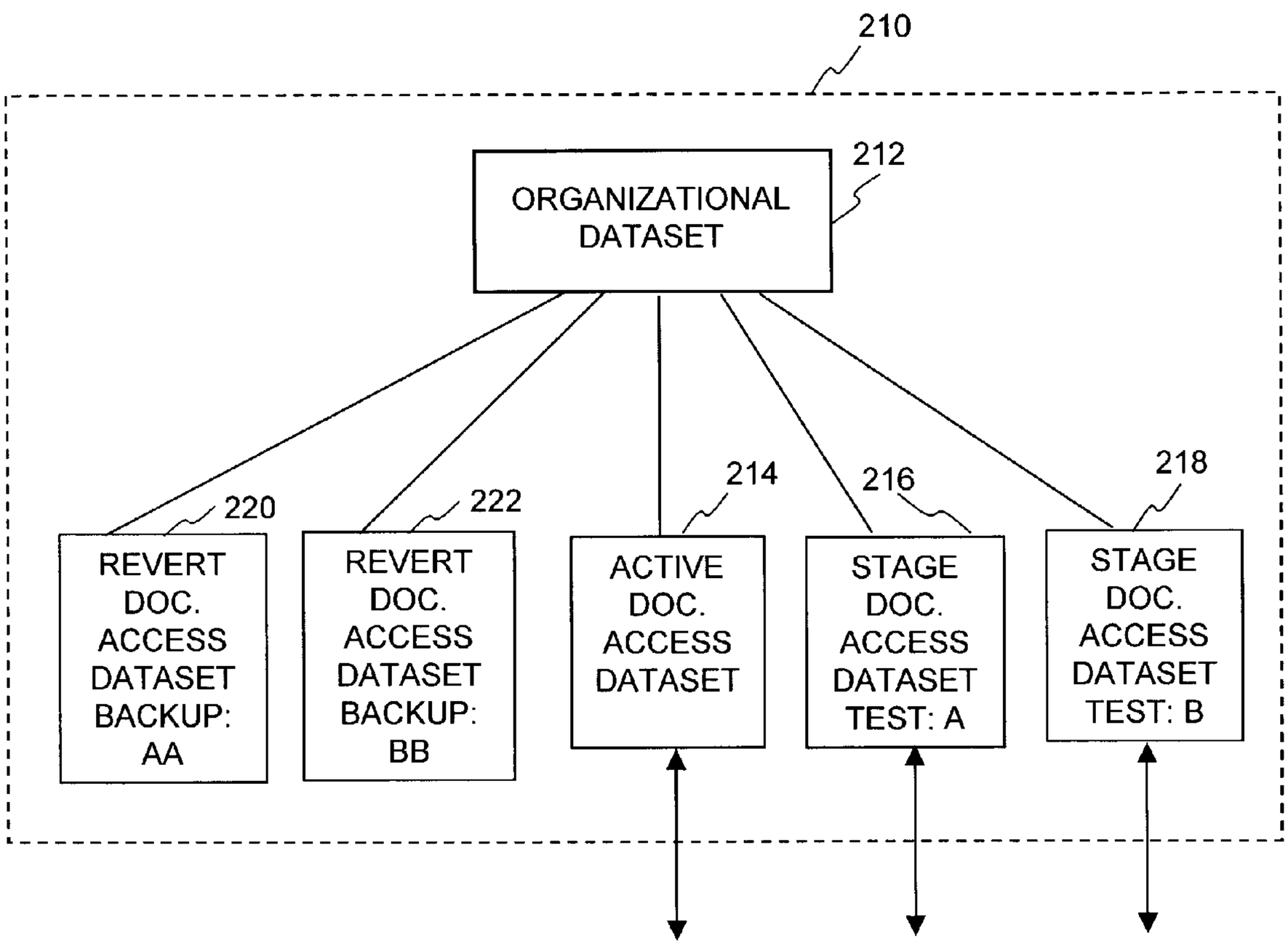
210
ORGANIZATIONAL DATASET
212
REVERT DOC. ACCESS DATASET BACKUP: AA
220
REVERT DOC. ACCESS DATASET BACKUP: BB
222
ACTIVE DOC. ACCESS DATASET
214
STAGE DOC. ACCESS DATASET TEST: A
216
STAGE DOC. ACCESS DATASET TEST: B
218

FIG. 2B

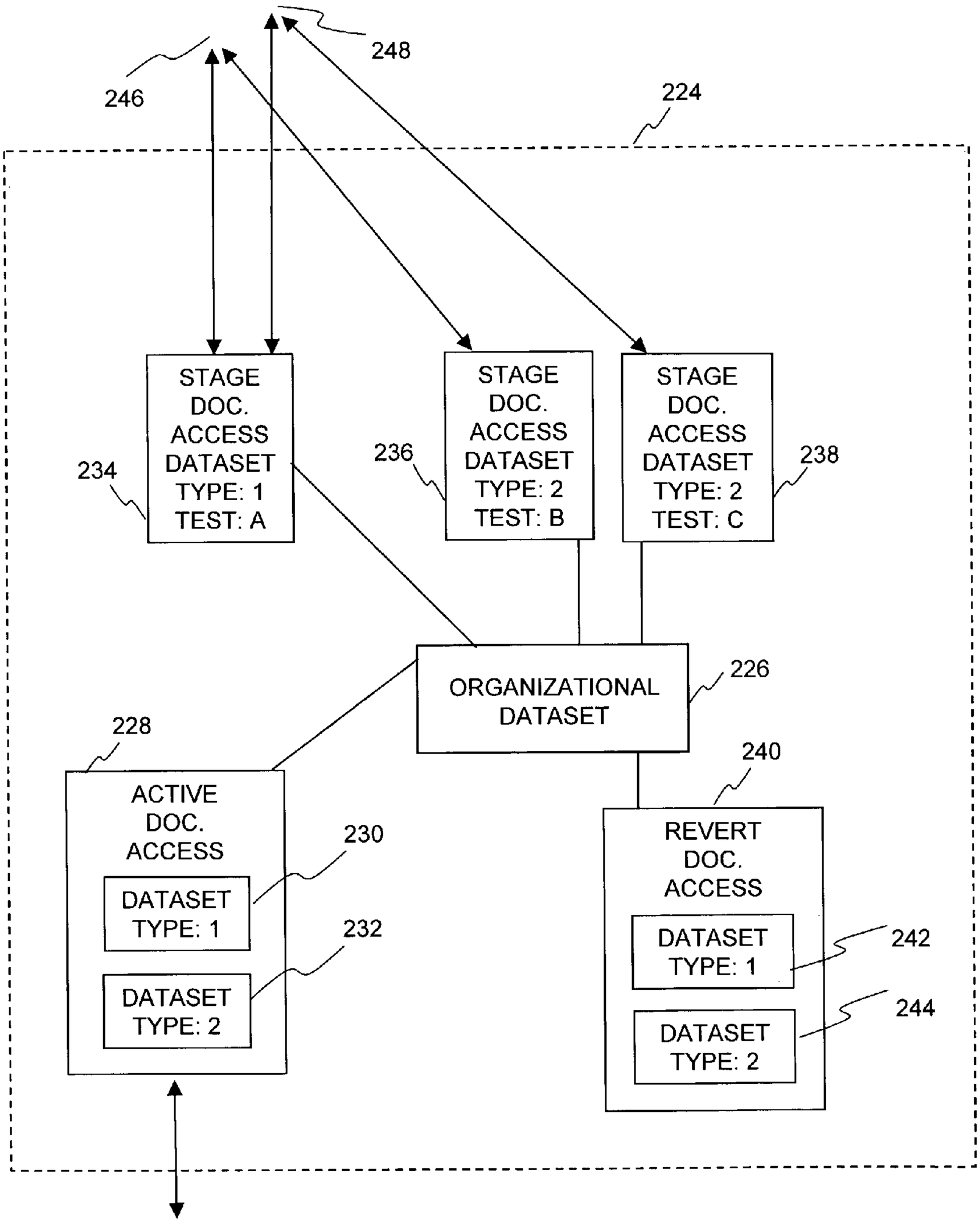
246
248
224
STAGE DOC. ACCESS DATASET TYPE: 1 TEST: A
234
STAGE DOC. ACCESS DATASET TYPE: 2 TEST: B
236
STAGE DOC. ACCESS DATASET TYPE: 2 TEST: C
238
ORGANIZATIONAL DATASET
226
228
ACTIVE DOC. ACCESS
DATASET TYPE: 1
230
DATASET TYPE: 2
232
240
REVERT DOC. ACCESS
DATASET TYPE: 1
242
DATASET TYPE: 2
244

FIG. 2C

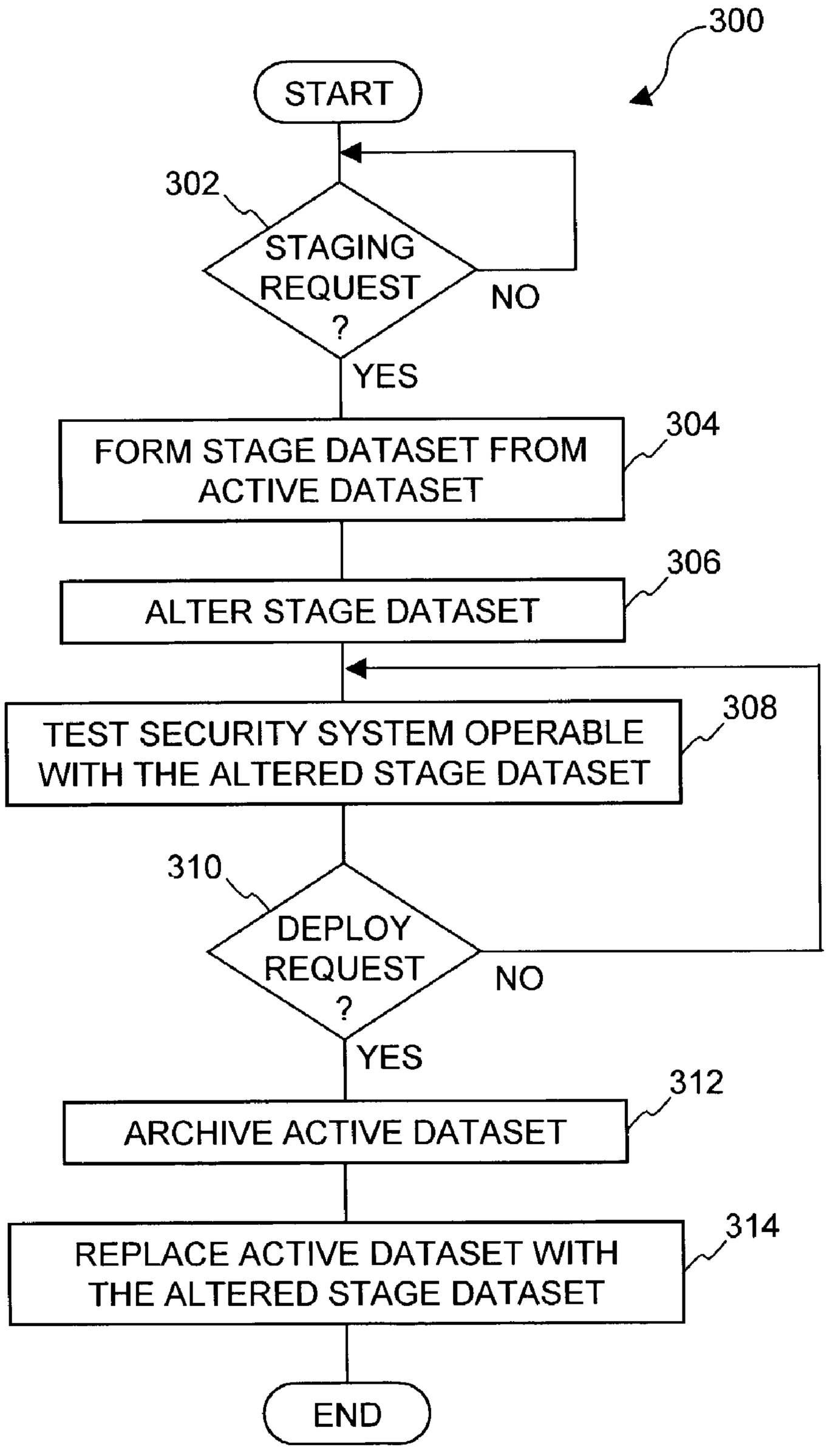
300
START
302
STAGING REQUEST ?
NO
YES
FORM STAGE DATASET FROM ACTIVE DATASET
304
ALTER STAGE DATASET
306
TEST SECURITY SYSTEM OPERABLE WITH THE ALTERED STAGE DATASET
308
310
DEPLOY REQUEST ?
NO
YES
ARCHIVE ACTIVE DATASET
312
REPLACE ACTIVE DATASET WITH THE ALTERED STAGE DATASET
314
END

FIG. 3

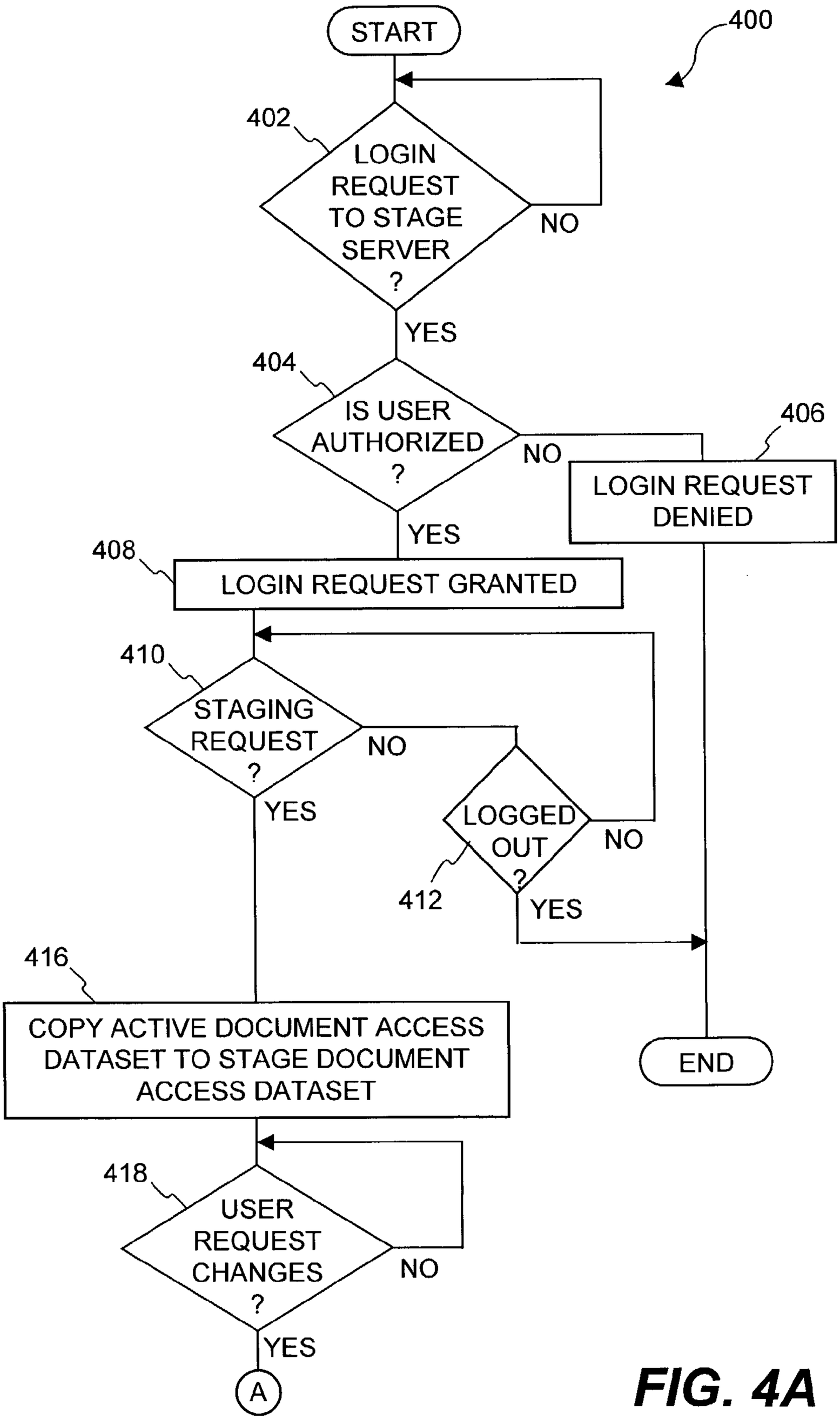
400
START
402
LOGIN REQUEST TO STAGE SERVER ?
NO
YES
404
IS USER AUTHORIZED ?
NO
406
LOGIN REQUEST DENIED
YES
408
LOGIN REQUEST GRANTED
410
STAGING REQUEST ?
NO
YES
LOGGED OUT ?
NO
412
YES
416
COPY ACTIVE DOCUMENT ACCESS DATASET TO STAGE DOCUMENT ACCESS DATASET
418
USER REQUEST CHANGES ?
NO
YES
A
END

FIG. 4A

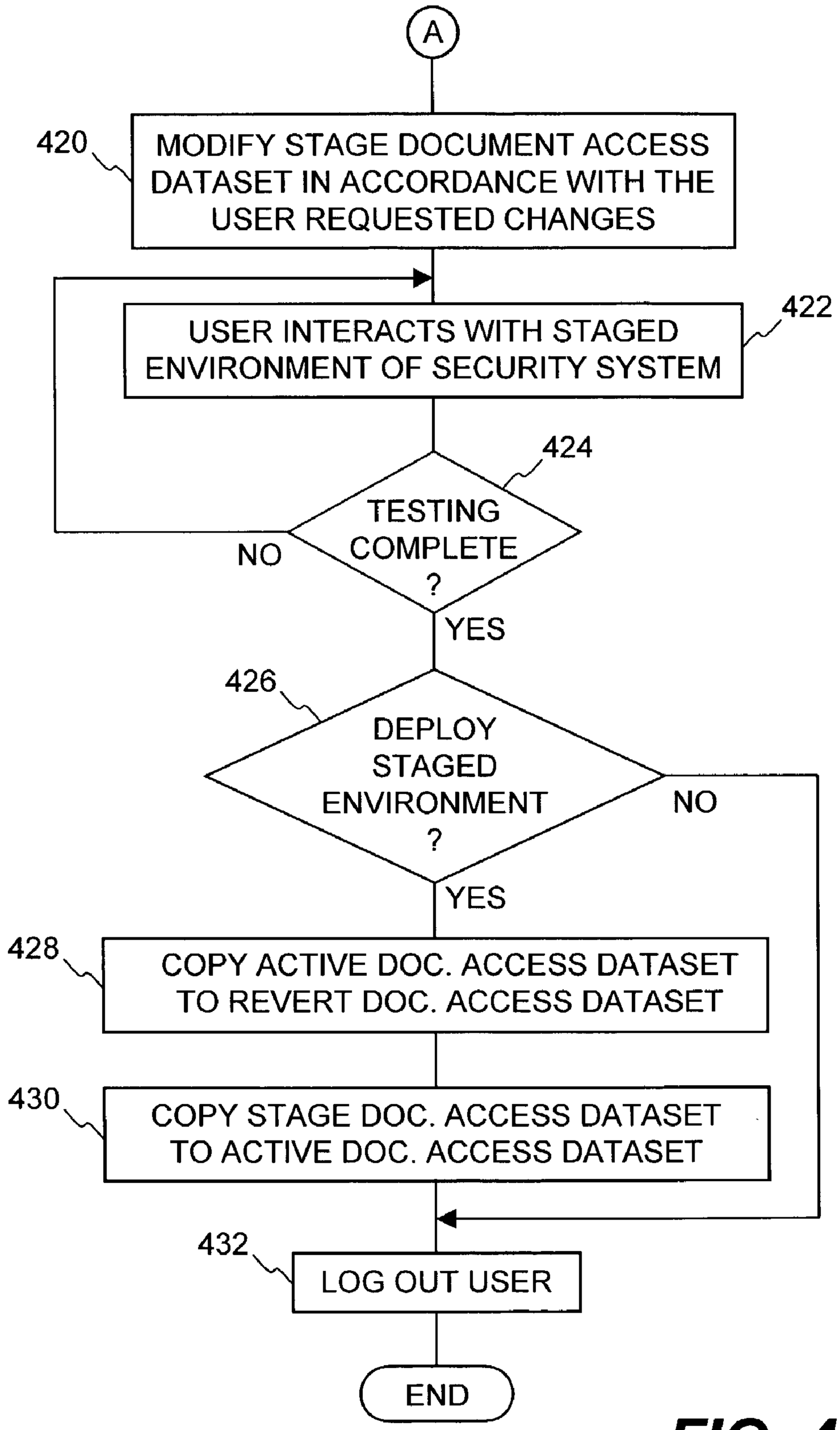
A
420
MODIFY STAGE DOCUMENT ACCESS DATASET IN ACCORDANCE WITH THE USER REQUESTED CHANGES
422
USER INTERACTS WITH STAGED ENVIRONMENT OF SECURITY SYSTEM
424
TESTING COMPLETE ?
NO
YES
426
DEPLOY STAGED ENVIRONMENT ?
NO
YES
428
COPY ACTIVE DOC. ACCESS DATASET TO REVERT DOC. ACCESS DATASET
430
COPY STAGE DOC. ACCESS DATASET TO ACTIVE DOC. ACCESS DATASET
432
LOG OUT USER
END

FIG. 4B

500

group_id	name	rule_id, vs	rule_text
0001	access_hrs	0001, deploy	< allow…>

FIG. 5A

502

group_id	name	rule_id, vs	rule_text
0001	access_hrs	0001, deploy	< allow…>
0001	access_hrs	0001, stage	< allow…>

FIG. 5B

504

group_id	name	rule_id, vs	rule_text
0001	access_hrs	0001, deploy	< allow…>
0001	access_hrs	0001, stage	< when… allow…>

FIG. 5C

506

group_id	name	rule_id, vs	rule_text
0001	access_hrs	0001, deploy	< allow…>
0001	access_hrs	0001, stage	<when…allow…>
0001	access_hrs	0001, revert	<allow…>

FIG. 5D

508

group_id	name	rule_id, vs	rule_text
0001	access_hrs	0001, stage	<when…allow…>
0001	access_hrs	0001, revert	<allow…>
0001	access_hrs	0001, deploy	<when…allow…>

FIG. 5E

SECURITY SYSTEM WITH STAGING CAPABILITIES

CROSS-REFERENCE TO RELATED APPLICATION

This application is related to: (i) U.S. patent application Ser. No. 10/075,194, filed Feb. 12, 2002, and entitled "SYSTEM AND METHOD FOR PROVIDING MULTI-LOCATION ACCESS MANAGEMENT TO SECURED ITEMS," which is hereby incorporated by reference for all purposes; (ii) U.S. application Ser. No. 10/186,203, filed Jun. 26, 2002, and entitled "METHOD AND SYSTEM FOR IMPLEMENTING CHANGES TO SECURITY POLICIES IN A DISTRIBUTED SECURITY SYSTEM," which is hereby incorporated by reference for all purposes; and (iii) U.S. application Ser. No. 10/206,737, filed Jul. 26, 2002, and entitled "METHOD AND SYSTEM FOR UPDATING KEYS IN A DISTRIBUTED SECURITY SYSTEM," which is hereby incorporated by reference for all purposes.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to security systems for data and, more particularly, to security systems that protect data in an inter/intra enterprise environment.

2. Description of Related Art

As organizations become more dependent on networks for business transactions, data sharing and everyday communications, their networks have to be increasingly accessible to customers, employees, suppliers, partners, contractors and telecommuters. Unfortunately, as the accessibility increases, so does the exposure of critical data that is stored on the network. Hackers can threaten all kinds of valuable corporate information resources including intellectual property (e.g., trade secrets, software code and competitive data), sensitive employee information (e.g., payroll figures and HR records), and classified information (e.g., passwords, databases, customer records, product information and financial data).

In protecting the proprietary information traveling across networks, one or more cryptographic techniques are often used to secure a private communication session between two communicating computers on the network. Cryptographic techniques provide a way to transmit information across an unsecure communication channel without disclosing the contents of the information to anyone who may be eavesdropping on the communication channel. An encryption process is a cryptographic technique whereby one party can protect the contents of data in transit from access by an unauthorized third party, yet the intended party can read the data using a corresponding decryption process.

Many organizations have deployed firewalls, Virtual Private Networks (VPNs) and Intrusion Detection Systems (IDS) to provide protection. Unfortunately, these various security means have been proven insufficient to reliably protect proprietary information residing on internal networks.

Even when security systems are available to protect electronic data, such systems need to be able to implement changes to the system as passwords, restrictions or criteria change. However, when using conventional approaches to implement changes to security systems, the impact or effectiveness of these changes to the security systems are often unknown or difficult to predict. The danger in making changes when the impact is unknown is that the changes can unexpectedly result in unintended consequences or system failure, resulting in scenarios in which authorized users are no

longer able to access electronic data they should be able to access, and/or unauthorized users are incorrectly able to access electronic data they should not be able to access. Further, it would be difficult to return the security system to its state prior to the changes.

Thus, there is a need for improved ways to implement changes to a security system.

SUMMARY OF THE INVENTION

The present invention relates to an improved system and method for providing a security system with the capability to stage a modification to its operation before actually modifying normal operation of the security system. If the staging of the modification to the security system is deemed successful, the modification can be fully deployed with reduced risk of unexpected security lapses or other detrimental consequences.

The present invention may be used in many types of security systems. These security systems operate to secure electronic data, such as files (e.g., files pertaining to documents). The invention can be implemented in numerous ways, including as a method, system, device, and computer readable medium. Several embodiments of the invention are discussed below.

As a method for altering access information of a security system, one embodiment of the invention includes at least the acts of: forming stage access information for staging with respect to the security system, the stage access information being based on active access information in use by the security system; altering the stage access information to modify the behavior of the security system while staging; testing the behavior of the security system while staging by operating in accordance with the altered stage access information; and thereafter deploying the altered stage access information so as to replace the active access information.

As a method for facilitating staging of alterations to access limitations of a security system, one embodiment of the invention includes at least the acts of: receiving a login request to a staging server from a user; determining whether the user is authorized to utilize the staging server; denying the login request when the user is not authorized to utilize the staging server; initializing the staging server with initial stage access limitations derived from active access limitations; modifying the initial stage access limitations to provide a staged environment; verifying operation of the security system in the staged environment while utilizing the modified stage access limitations; and deploying the staged environment as an active environment of the security system.

As a security system for restricting access to secured electronic documents associated with an entity, one embodiment of the invention includes at least: an active server that provides an active environment that enforces security on the secured electronic documents in accordance with organizational information of the entity and active document access information; a staging server that provides a staging environment to test security imposed on the secured electronic documents in accordance with the organizational information of the entity and stage document access information; and a database including at least the organizational information of the entity for use by both the active server and the staging server, the active document access information for use by the active server, and the stage document access information for use by the staging server.

As a computer readable medium including at least computer program code for altering access information of a security system, one embodiment of the invention includes at

least: computer program code for forming stage access information for staging with respect to the security system, the stage access information being based on active access information in use by the security system; computer program code for altering the stage access information to modify the behavior of the security system while staging; and computer program code for thereafter deploying the altered stage access information so as to replace the active access information.

As a computer readable medium including at least computer program code for facilitating staging of alterations to access limitations of a security system, one embodiment of the invention includes at least: computer program code for receiving a login request to a staging server from a user; computer program code for determining whether the user is authorized to utilize the staging server; computer program code for denying the login request when the user is not authorized to utilize the staging server; computer program code for initializing the staging server with initial stage access limitations derived from active access limitations; computer program code for modifying the initial stage access limitations to provide a staged environment; computer program code for verifying operation of the security system in the staged environment while utilizing the modified stage access limitations; and computer program code for deploying the staged environment as an active environment of the security system.

As a computer readable medium including at least computer program code for altering access information of a security system, the security system operates to restrict access to secured electronic data based on the access information, one embodiment of the invention includes at least: computer program code for obtaining stage access information for staging with respect to the security system; and computer program code for deploying the stage access information to be used as the access information for normal operational use of the security system in restricting access to the secured electronic data.

Other objects, features, and advantages of the present invention will become apparent upon examining the following detailed description of an embodiment thereof, taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

FIG. **1** is a security system according to one embodiment of the invention.

FIGS. **2**A-**2**C are block diagrams of security information stored within a security system database according to several embodiments of the invention.

FIG. **3** is a flow diagram of staging and deploying processing according to one embodiment of the invention.

FIGS. **4**A and **4**B are flow diagrams of staging and deploying processing according to another embodiment of the invention.

FIGS. **5**A-**5**E illustrate a series of different versions of a rules table according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to an improved system and method for providing a security system with the capability to stage a modification to its operation before actually modifying normal operation of the security system. If the staging of the modification to the security system is deemed successful, the modification can be fully deployed with reduced risk of unexpected security lapses or other detrimental consequences.

The present invention may be used in many types of data systems, including security systems. These security systems operate to secure electronic data, such as files (e.g., files containing documents). To facilitate the description of the present invention, unless specifically stated, a security system or a file security system are interchangeably used herein. A file security system (or document security system) serves to limit access to files (documents) only to authorized users. Often, an organization, such as a company, would use a file security system to limit access to its files (documents). For example, users of a group might be able to access files (documents) pertaining to the group, whereas other users not within the group would not be able to access such files (documents). Such access, when permitted, would allow a user of the group to retrieve a copy of a file (document) pertaining to the group via a data network.

Secured files are files that require one or more keys, passwords, access privileges, etc. to gain access to their content. In one embodiment, the security is provided through encryption and access rules. Access data (such as keys and access privileges) can be stored in one or more data stores of a server, and distributed by the server to certain users (e.g., users who belong to appropriate groups). The files, for example, can pertain to documents, multimedia files, data, executable code, images and text. In general, a secured file can only be accessed by authenticated users with appropriate access rights or privileges. In one embodiment, each secured file is provided with a header portion and a data portion, where the header portion contains or points to security information. The header portion may contain security constraints that are to be processed in conjunction with the access data distributed by the server. The security information is used to determine whether access to associated data portions of secured files is permitted.

As used herein, a user may mean a human user, a software agent, a group of users, a member of a group of users, a device and/or application. Beside a human user who needs to access a secured document, a software application or agent sometimes needs to access secured files in order to proceed. Accordingly, unless specifically stated, the "user" as used herein does not necessarily pertain to a human being.

In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will become obvious to those skilled in the art that the invention may be practiced without these specific details. The description and representation herein are the common meanings used by those experienced or skilled in the art to most effectively convey the substance of their work to others skilled in the art. In other instances, well-known methods, procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the present invention.

Reference herein to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or diagrams representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Embodiments of the present invention are discussed herein with reference to FIGS. **1**-**5**E. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments.

FIG. **1** is a security system **100** according to one embodiment of the invention. The security system **100** supports an active environment and a staging environment. The active environment is the normal operating environment for the security system **100**. The staging environment is a logically separate environment that can be used to test or stage the impact of changes to the security system before actually implementing such changes in the active environment.

The security system **100** includes an active server **102** and a security system database **104**. Together the active server **102** and the security system database **104** provide the core of the security system **100**. The active server **102** operates to restrict access to secured files (e.g., documents) such that only authorized users are able to gain access. In doing so, the active server **102** performs processing to authenticate users and, possibly in conjunction with client software, verify their privileges and/or rights with respect to secured files. In managing the security of the secured files, the active server **102** interacts with the security system database **104** that stores security information. The security information governs whether, where and/or when users or groups of users are able to gain access to the secured files.

The security system **100** allows users **106**, **108** and **110** to gain access to secured files via the active server **102**. The secured files can be stored in a variety of different locations, such as at a user's computing device, the active server **102**, the security system database **104**, or some other storage area accessible by the active server **102**. When one of the users **106**, **108** and **110** attempts to access a secured file (after having successfully logged into the active server **102**), the active server **102** evaluates whether the requesting user satisfies the policies and rules associated with accessing the secured file as are identified within the security system database **104**.

In addition, the security system **100** is configured to permit staging such that changes to the security information utilized by the security system can be tested to verify integrity of the security system with such changes prior to being fully deployed. In this regard, the staging environment allows a system administrator (e.g., user **110**) to interact with a stage server **112** to alter the security information stored within the security system database **104** for the purposes of providing a staging environment. However, the presence or use of the staging environment does not invalidate, alter, or make inaccessible, the active security environment. If the system administrator is satisfied with the security provided by the security system in the staging environment, then the system administrator can elect to deploy the staged environment such that the staged environment becomes the active environment of the security system. In one implementation, the system administrator would not be permitted to simultaneously log into the active server **102** and the stage server **112**, so as to avoid accidental alteration of the security information in the security system database **104**.

According to one embodiment, the security information stored in the security system database **104** includes organizational information as well as document access information. More generally, the document access information can be considered file access information. However, in the embodiments discussed below, the files are primarily documents; hence, the phrase document access information is used. In one embodiment, the organizational information includes information on users or groups of users, and the document access information includes information on rights and/or privileges for accessing particular documents.

FIG. **2**A illustrates a block diagram of security information **200** stored within a security system database according to one embodiment of the invention. The security system database storing the security information **200** can, for example, be the security system database **104** illustrated in FIG. **1**.

The security information **200** includes organizational dataset **202**, active document access dataset **204**, stage document access dataset **206**, and revert document access dataset **208**. The organizational dataset **202** provides information pertaining to an entity that is affiliated with the security system. In other words, typically, the security system is provided for a particular entity (e.g., company) and access rights to secured documents associated with the entity are arranged to be in accordance with the organizational dataset **202**. For example, the organizational dataset **202** can identify a plurality of different groups of users, which can change as users are promoted, demoted, transferred within the company, hired or fired. In addition, the security information **200** stores document access information which pertains to access policies and/or rules associated with particular secured documents. The document access dataset is provided in three logically separate areas of the security system database **200**. The three separate areas that contain the document access dataset respectively include the active document access dataset **204**, the stage document access dataset **206**, and the revert document access dataset **208**. Although these different types of document access information are logically distinct and outwardly separate, they can reside in or share the same database tables of the security information **200**. In any case, the organizational dataset **202** is common across the different types of document access information (active, stage and revert). The datasets **204**, **206**, and **208** are all synchronized with the dataset **202**, as explained below with respect to FIGS. **5**A-**5**E. Hence, the organizational dataset **202** is thus utilized regardless of whether the security system is operating in an active environment or a staged environment. The revert document access dataset **208** is meant to backup the active document access dataset **204**. Namely, when the active document access dataset **204** is overwritten with the stage document access dataset **206**, the revert copy of the active document access dataset (i.e., the revert document access dataset **208**) affords restore of the old active document access dataset (provided the old active document access dataset was concomitantly and atomically copied to one of the revert document access datasets). Hence, the revert document access dataset **208** is never used directly.

FIG. **2**B illustrates a block diagram of security information **210** stored within a security system database according to another embodiment of the invention. The security system database storing the security information **210** can, for example, be the security system database **104** illustrated in FIG. **1**.

The security information **210** includes organizational dataset **212**, active document access dataset **214**, multiple stage document access datasets **216** and **218**, and multiple revert document access datasets **220** and **222**. There is only one active document access dataset **214**. The organizational dataset **212** provides information pertaining to an entity that is affiliated with the security system. In other words, typically, the security system is provided for a particular entity (e.g., company) and access rights to secured documents associated with the entity are arranged to be in accordance with the organizational dataset **212**. For example, the organizational

dataset **212** can identify a plurality of different groups of users, which can change as users are promoted, demoted, transferred within the company, hired or fired. In addition, the security information **210** stores document access information which pertains to access policies and/or rules associated with particular secured documents. The document access information is provided in three logically separate areas of the security information **210**. The three separate areas that contain the document access information respectively include the active document access dataset **214**, the stage document access datasets **216** and **218**, and the revert document access datasets **220** and **222**. Although these different types of document access information are logically distinct and outwardly separate, they can reside in or share the same database tables of the security system database **210**. In any case, the organizational dataset **212** is common across the different types of document access information (active, stage and revert). The datasets **214**, **216**, **218**, **220**, **222** and **208** are all synchronized with the dataset **212**, as explained below with respect to FIGS. **5**A-**5**E. Hence, the organizational dataset **212** is utilized regardless of whether the security system is operating in an active environment or a staged environment. The revert document access datasets **220** and **222** are meant to backup the active document access dataset **214**. Namely, when the active document access dataset **214** is overwritten with the stage document access dataset, the revert copies of the active document access dataset (e.g., revert document access datasets **220** or **222**) afford restore of the old active document access dataset (provided the old active document access dataset was concomitantly and atomically copied to one of the revert document access datasets). Hence, the revert document access datasets **220** and **222** are never used directly.

The multiple stage document access datasets allow for simultaneous staging and testing of different security scenarios. For example, users may be assigned to stage test groups, with each of the users being responsible for testing one stage document access dataset.

Multiple revert document access datasets allow for multiple full backups. One revert document access dataset may be copied to another revert document access dataset. The active document access dataset may be copied to a revert document access dataset without the concomitant copying of a stage document access dataset to the active document access dataset (this could be useful if changes are made directly to the active document access dataset, which procedure is possible although not recommended). Other additional operations not possible with the embodiment discussed above in connection with FIG. **2**A may be afforded.

FIG. **2**C illustrates a block diagram of security information **224** stored within a security system database according to yet another embodiment of the invention. The security system database storing the security information **224** can, for example, be the security system database **104** illustrated in FIG. **1**.

The security information **224** includes organizational dataset **226**, active document access dataset **228**, stage document access dataset, and revert document access dataset **240**. In this embodiment, the document access datasets has multiple types, namely, Type 1 and Type 2. Type 1 could be centrally-mandated folders, and Type 2 could be access policies. The active document access dataset **228** has a Type 1 dataset **230** and a Type 2 dataset **232**. There is only one such combined active document access dataset. The revert document access dataset **240** has a Type 1 dataset **242** and a Type 2 dataset **244**. There can be many such combined revert document access datasets, as in the embodiment specified above in FIG. **2**B. The organizational dataset **226** provides information pertaining to an entity that is affiliated with the security system. In other words, typically, the security system is provided for a particular entity (e.g., company) and access rights to secured documents associated with the entity are arranged to be in accordance with organizational dataset **226**. For example, the organizational dataset **226** can identify a plurality of different groups of users, which can change as users are promoted, demoted, transferred within the company, hired or fired. In addition, the document access information pertains to access policies and/or rules associated with particular secured documents. The document access information is provided in three logically separate areas of the security information **224**. The three separate areas that contain the document access information respectively include the active document access dataset **228**, the stage document access datasets **234**, **236** and **238**, and the revert document access dataset **240**. Although these different types of document access information are logically distinct and outwardly separate, they can reside in or share the same database tables of the security information **224**. In any case, the organizational dataset **226** is common across the different types of document access information (active, stage and revert). The datasets **230**, **232**, **234**, **236**, **238**, **242** and **244** are all synchronized with the organizational dataset **226**, as explained below in FIGS. **5**A-**5**E. Hence, the organizational dataset **226** is utilized regardless of whether the security system is operating in an active environment or a staged environment. The revert document access datasets **242** and **244** are meant to backup the active document access datasets **230** and **232**. For example, when the active document access dataset is overwritten with a stage document access dataset, a revert copy of the active document access dataset affords restore of the old active document access dataset. Hence, the revert document access datasets are never used directly.

This embodiment affords the testing of different combinations of staging document access datasets, each combination being comprised of one staging document access dataset per document access dataset type. Two such representative combinations **246** and **248** are shown in FIG. **2**C. Users may be assigned to stage test groups, each responsible for testing of one stage document access dataset combination.

This embodiment further affords revert document access datasets to be combinations of staging document access datasets, each combination being comprised of one staging document access dataset per document access dataset type. This allows flexible backup of staging combinations. Other additional operations not possible with the embodiments discussed above in connection with FIGS. **2**A-**2**B may be afforded.

FIG. **3** is a flow diagram of staging and deploying processing **300** according to one embodiment of the invention. The staging and deploying processing **300** is, for example, performed by a security system, such as the security system **100** illustrated in FIG. **1**.

The staging and deploying processing **300** begins with a decision **302** that determines whether a staging request has been received. When the decision **302** determines that a staging request has not yet been received, the staging and deploying processing **300** awaits such a request. In other words, the staging and deploying processing **300** can be considered to be invoked once the staging request has been received.

In any case, once the decision **302** determines that a staging request has been received, a stage dataset is formed **304** from the active dataset. The active dataset is associated with an active environment of the security system under which the security system normally operates. A stage dataset is a separate dataset that is utilized in a staging environment to stage or

test a different implementation of the security system due to differences between the stage dataset and the active dataset. For example, the stage dataset can be one of the multiple stage datasets (or possibly dataset combinations) available in a security system data store such as shown in FIGS. **2**A-**2**C. When the stage dataset is formed **304**, it is normally the same or similar (at least initially) to the active dataset because, in at least one embodiment, it is derived from the active dataset. Next, the staged dataset is altered **306**. Here, the staged dataset is altered **306** such that the staging environment is provided by the alteration. Normally, such alteration would be initiated by a system administrator of the security system. At least one embodiment prevents a system administrator from altering both the active dataset and a stage dataset in the course of a single login, to minimize mistakes.

Next, the security system operates in accordance with the altered stage dataset to test **308** the security system in the staged environment. Here, the testing is typically initiated and performed by a user (e.g., system administrator) through interaction with the security system. A decision **310** then determines whether a deploy request has been received. The deploy request is typically a request provided by the system administrator that instructs the security system to deploy the staging environment such that it becomes the active environment. In other words, when the testing of the security system in accordance with the altered stage data set has proven to be successful, a system administrator can issue a deploy request. Alternatively, the system administrator could be unsatisfied with the test **308** of the security system and thus choose to not deploy the staging environment of the security system; an administrator could then order testing resumed, further alter the stage dataset and then order testing started afresh, or start over by sending another staging request to be processed. Here, in the embodiment shown in FIG. **3**, it is assumed that the system administrator was at some point satisfied with the test **308** of the security system. Hence, when the decision **310** determines that a deploy request has not yet been received, the staging and deploying processing **300** awaits such a request. Once the decision **310** determines that a deploy request has been received, the staging environment is deployed such that it becomes the active environment. More particularly, in deploying the staging environment, the active dataset is archived **312**. The archived version of the active dataset is also known as a revert dataset. By archiving the active dataset, the active dataset is able to be subsequently retrieved in the case in which the security system is to be reverted back to the prior active dataset. After the active data set has been archived **312**, the active dataset is replaced **314** with the altered stage dataset. In effect, the replacement **310** of the active dataset with the altered stage dataset operates to deploy the staging environment to the active environment. The operations **312** and **314** are typically contained in an atomic transaction. Following the operation **314**, the staging and deploying processing **300** is complete and ends.

FIGS. **4**A and **4**B are flow diagrams of staging and deploying processing **400** according to one embodiment of the invention. The staging and deploying processing **400** is, for example, performed by a security system, such as the security system **100** illustrated in FIG. **1**.

The staging and deploying processing **400** begins with a decision **402** that determines whether a login request to a stage server has been received. When the decision **402** determines that a login request has not yet been received, the staging and deploying processing **400** awaits such a request. In effect, the staging and deploying processing **400** can be considered to be invoked once a login request has been received.

Once the decision **402** determines that a login request to the stage server has been received, a decision **404** determines whether the user is authorized. The user that is making the login request is typically a staging administrator for the security system, which is a particular type of system administrator that has authorization to perform staging operations. When the decision **404** determines that the user is not authorized, then the login request is denied **406**. In at least one embodiment, decision **404** also determines the stage dataset or dataset combination that the user making login request desires to access.

On the other hand, when the decision **404** determines that the user is authorized, then the login request is granted **408**. At this point, the user is logged into the stage server and can thus perform staging operations. In one implementation, the user would not be permitted to be simultaneously logged into the active server, so as to avoid accidental alteration of active data. Next, a decision **410** determines whether a staging request has been received. The staging request is a particular request to initiate staging (or to invoke staging operations). When the decision **410** determines that a staging request has not yet been received, a decision **412** determines whether the user has been logged out. When the decision **412** determines that the user should be logged out, then the user is logged out from the stage server. Hence, following the operations **406** and **414**, the staging and deploying processing **400** ends with no staging having been performed.

Alternatively, when the decision **412** determines that the user has not logged out, then the staging and deploying processing **400** returns to repeat the decision **410** to await the receipt of a staging request. Once the decision **410** determines that a staging request has been received, active document access dataset is copied **416** to a stage document access dataset. For example, as shown in FIGS. **2**A-**2**C, the active document access dataset is a body of data within the security system database that is separate from the stage document access dataset. According to one embodiment, the document access dataset can include rules and/or policies that govern access to documents. Often, any preexisting stage document dataset would be deleted before the active document access dataset is copied **416** over to become the stage document access dataset.

Next, a decision **418** determines whether user-requested changes to the stage document access dataset have been received. When the decision **418** determines that user-requested changes have not yet been received, the staging and deploying processing **400** typically awaits such requested changes. However, it should be noted that the processing could time-out or otherwise end if no user-requested changes are received. When the decision **418** determines that user-requested changes have been received, then the stage document access dataset is modified **420** in accordance with the user requested changes. Thereafter, the user interacts **422** with the staged environment of the security system to test its operability and robustness. The staged environment of the security system that is provided is through use of the modified stage document access dataset. Next, a decision **424** determines whether testing of the staged environment has completed. When the user (staging administrator) determines that the staged environment has not yet been sufficiently tested, then the staging and deploying processing **400** can return to repeat the operation **422** and subsequent operations.

On the other hand, when the user (staging administrator) determines that testing of the staged environment is complete, then a decision **426** determines whether the staged environment is to be deployed. When the decision **426** determines that the staged environment is to be deployed, then the active

document access dataset is copied **428** to revert document access dataset. For example, as shown in FIG. **2**A, the revert document access dataset can be a separate body of information within the security system database. Next, the stage document access dataset is copied **430** to the active document access dataset. In effect, operations **428** and **430** operate to first archive the current active document access dataset and then replace the current active document access dataset with the staged document access dataset which then becomes the new current active document access dataset, thereby deploying the previously staged environment. The operations **428** and **430** are typically contained in an atomic transaction. Alternatively, when the decision **426** determines that the staged environment is not to be deployed, the operations **428** and **430** are bypassed. Following the operation **430** or its being bypassed, the user is logged out **432** from the stage server. After the user is logged out **432**, the staging and deploying processing **400** ends.

The document access information stored within the security system database can include information on rules and/or policies. These rules and/or policies are typically stored within the security system database as tables. More generally, other data objects can be considered document access data and included in document access information (e.g., document access datasets). Although the discussion below refers primarily to rules, the principles apply to other data objects as well.

FIGS. **5**A-**5**E illustrate a series of different versions of a relational rules table according to one embodiment of the invention. The rules table shown in FIGS. **5**A-**5**E is an exemplary portion of the document access information that might be stored within a security system database in the context of a rule. In general, a rule is a condition for document access that must be satisfied in order for a requestor to gain access to the corresponding document. Hence, if a document requires the satisfaction of a particular rule, then the rule must be satisfied before the requestor is permitted to gain access to the corresponding document.

As shown in rules table **500** of FIG. **5**A, a rule is identified by rule identifier (rule_id) "0001", is named "access_hrs" and is for use with the "deploy" version space (version_space or vs). The "deploy" version space corresponds to the active document access dataset **204** illustrated in FIG. **2**A. In one embodiment, a unique identifier being utilized is a composite key including a rule identifier and a version space (rule_id, version_space). The rule itself is defined by rule criteria (rule_text) provided within the rules table **500** as "<allow . . . >".

When staging is initiated, the rule identified by the rule identifier "0001" will be copied from the "deploy" version space to the "stage" version space, where the "stage" version space corresponds to the stage document access dataset **206** illustrated in FIG. **2**A, for example. Hence, as shown in FIG. **5**B, rules table **502** is updated as compared to the rules table **500** shown in FIG. **5**A. Namely, the rules table **502** includes a new entry identified by the composite key provided by the rule identifier (rule_id) "0001" and the version space "stage". At this point, the new entry pertains to the same rule as the rule identified by the rule identifier "0001" and version pace "active", and thus has the same name (access_hrs) and rule criteria (rule_text). However, the composite key for the two entries in the rules table **502** are different between these two rule instances. More particularly, the first entry in the rules table **502** is still affiliated with the "deploy" version space, whereas the second entry in the rules table **502** is affiliated with the "stage" version space.

Next, to implement a distinct staging environment, the system administrator interacts with the security system to alter the rule uniquely identified by the rule identifier "0001" and the version space "stage". Hence, as shown in FIG. **5**C, the second entry of rules table **504** indicates that the rule text (rule_text) has been altered for purposes of the staged environment. At this point, the system administrator can utilize the stage environment to test whether or not the modified rule having the rule identifier "0001" and the version space "stage" is sufficiently successful to be deployed. When the staged environment is to be deployed, a two-step process can be utilized. The first step is shown in FIG. **5**D, and the second step is shown in FIG. **5**E.

The version of rules table **506** shown in FIG. **5**D includes the same two entries as in FIG. **5**C, with the addition of a third entry uniquely identified by the rule identifier "0001" and the version space "revert". The third entry in the rules table **506** represents a copy of the rule associated with the "deploy" version space (i.e., the first entry, namely, the rule pertaining to the rule identifier "0001" and the version space "deploy"). Hence, the rule identified by the third entry is essentially a copy of the rule identified by the first entry with the differences being the different rule identifiers and the different version spaces. The "revert" version space is, for example, associated with the revert document access dataset **208** illustrated in FIG. **2**A.

After the third entry has been provided in the rules table **506** for the "revert" version space as shown in FIG. **5**D, the rule from the "stage" version space is copied to the "deploy" version space. As shown in FIG. **5**E, rules table **508** is now updated such that the previous first entry is deleted and a new first entry is provided for the "deploy" version space which is added. Note that although the rule identifier and version spaces differ between the first and third entries in the rules table **508**, the names and the rule text for the rules are the same.

The versions of the relational rules tables **500**, **502**, **504**, **506** and **508** shown in FIGS. **5**A-**5**E also include a group identifier (group_id). The group identifier defines a rule's relationship with some particular group of users. The relationship can be defined through any other deterministic relational or non-relational mapping.

In one embodiment, group objects are part of the organizational dataset (e.g., organizational dataset shown in FIGS. **2**A-C). The other datasets (e.g., active, stage and revert datasets) are synchronized with the organizational dataset. Specifically, when a group is deleted in the organizational dataset, all other dataset records referencing that group are also deleted. In this way, revert, stage and active datasets never include an invalid rule (i.e., a rule that requires membership in a deleted group). According to one embodiment, when a rule references multiple groups and one of those groups is deleted, the rule is automatically edited by the security system to exclude reference to the deleted group, instead of deleting the entire rule. Hence, each rule can reference one or more groups. Although the rules tables shown in FIGS. **5**A-**5**E reference a single group identified by group identifier "0001", the entries in the rules tables can reference more than one group.

According to one embodiment, the security system can perform an operation to merge groups A and B into group C, and can then cause rules associated with groups A and B to become re-associated with group C. Further, the security system can also perform an operation to split group C into groups A and B, and can then cause rules associated with group C to become re-associated with both groups A and B.

In another embodiment, the security system can provide for permanent and semi-permanent groups. In such an embodiment, rules can only be associated with the permanent groups and not the semi-permanent groups. Such would guar-

antee that as long as no permanent groups were deleted since the active document access dataset was copied to a particular revert document access dataset, the particular revert document access dataset would have a superior degree of validity.

Additional details on a security system can be found in (i) U.S. patent application Ser. No. 10/075,194, filed Feb. 12, 2002, and entitled "SYSTEM AND METHOD FOR PROVIDING MULTI-LOCATION ACCESS MANAGEMENT TO SECURED ITEMS," which is hereby incorporated by reference for all purposes; (ii) U.S. application Ser. No. 10/186,203, filed Jun. 26, 2002, and entitled "METHOD AND SYSTEM FOR IMPLEMENTING CHANGES TO SECURITY POLICIES IN A DISTRIBUTED SECURITY SYSTEM," which is hereby incorporated by reference for all purposes; and (iii) U.S. application Ser. No. 10/206,737, filed Jul. 26, 2002, and entitled "METHOD AND SYSTEM FOR UPDATING KEYS IN A DISTRIBUTED SECURITY SYSTEM," which is hereby incorporated by reference for all purposes.

The invention is preferably implemented by software or a combination of hardware and software, but can also be implemented in hardware. The invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include tangible media such as read-only memory, random-access memory, CD-ROMs, DVDs, magnetic tape, and optical data storage devices. The tangible computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

The various embodiments, implementations and features of the invention noted above can be combined in various ways or used separately. Those skilled in the art will understand from the description that the invention can be equally applied to or used in other various different settings with respect to various combinations, embodiments, implementations or features provided in the description herein.

The advantages of the invention are numerous. Different embodiments or implementations may yield one or more of the following advantages. One advantage of the invention is that changes to a security system can be staged before deployment. Another advantage of the invention is that merge conflicts between different access data can be minimized or managed. Still another advantage of the invention is that organizational data can be common while access data can be different for staging and deployment.

The many features and advantages of the present invention are apparent from the written description, and thus, it is intended by the appended claims to cover all such features and advantages of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation as illustrated and described. Hence, all suitable modifications and equivalents may be resorted to as falling within the scope of the invention.

What is claimed is:

1. A method comprising:

forming access information for staging with respect to a security system, wherein the security system operates to restrict access to secured electronic data based on access information, wherein the access information includes or references one or more of access rules or access policies including at least when and where the secured electronic data can be accessed by a plurality of users, wherein the access information is based on active access information currently in use by the security system, and wherein the active access information and the access information is stored in a database operatively connected to the security system;

forming altered access information to modify the behavior of the security system during the staging;

testing the behavior of the security system during the staging by operating the security system in accordance with the altered access information; and

deploying the altered access information so as to synchronize the active access information stored in the database with the altered access information.

2. The method as recited in claim **1**, wherein the security system thereafter operates in the manner as previously staged.

3. The method as recited in claim **1**, wherein forming altered access information comprises modifying at least one of the access rules or at least one of the access policies of the access information to produce the altered access information.

4. The method as recited in claim **1**, wherein forming access information for staging is configured by a user, and

wherein forming altered access information is performed in accordance with input provided by the user.

5. The method as recited in claim **1**, wherein forming access information for staging is configured by a user, and

wherein the testing of the behavior of the security system is performed in accordance with input provided by the user.

6. The method as recited in claim **1**, wherein forming access information for staging comprises copying the active access information to the access information.

7. The method as recited in claim **1**, wherein the deploying of the altered access information comprises:

archiving the active access information in use by the security system; and

replacing the active access information with the altered access information.

8. The method as recited in claim **7**,

wherein forming altered access information comprises modifying at least one of the access rules or at least one of the access policies of the access information to produce the altered access information.

9. A method comprising:

initializing a staging server with initial access limitations derived from active access limitations, wherein a security system operates to restrict access to secured electronic data based on the access limitations, the access limitations including at least when and where the secured electronic data can be accessed by one or more user groups, and wherein the active access limitations are stored in a database operatively connected to the security system;

modifying the initial access limitations to provide a staged environment;

verifying operation of the security system in the staged environment while utilizing the modified access limitations; and

deploying the staged environment as an active environment of the security system so as to synchronize the active access limitations stored in the database with the modified access limitations.

10. The method as recited in claim **9**, wherein the security system includes an active server for normal operation and the staging server for staging changes to the security system.

11. The method as recited in claim **10**, wherein the active environment is provided through use of the active access limitations and the active server of the security system.

12. The method as recited in claim 9, wherein the initializing comprises copying the active access limitations to the initial access limitations.

13. The method as recited in claim 9, wherein the modifying of the initial access limitations is performed in accordance with selections from a user.

14. The method as recited in claim 9, wherein the deploying comprises:

replacing the access limitations of the security system with the modified access limitations.

15. The method as recited in claim 9, wherein the deploying comprises:

archiving the access limitations of the security system; and

replacing the access limitations of the security system with the modified access limitations.

16. The method as recited in claim 9, wherein the active access limitations include or reference one or more of access rules or access policies.

17. The method as recited in claim 16, wherein the initial access limitations include or reference one or more of access rules or access policies.

18. A system comprising:

an active server configured to enforce access limitations regarding secured electronic documents in accordance with organizational information of an entity and active document access information, wherein the active document access information includes or references one or more of access rules or access policies including at least when and where the secured electronic documents can be accessed by one or more user groups;

a staging server configured to test access limitations imposed on the secured electronic documents in accordance with the organizational information of the entity and document access information, wherein the document access information includes or references one or more of access rules or access policies including at least when and where the secured electronic documents can be accessed by the one or more user groups; and

a database stored in a computer readable storage medium, wherein the database is operatively connected to the active server and the staging server, wherein the database includes at least the organizational information of the entity synchronized for use by both the active server and the staging server, the active document access information for use by the active server, and the document access information for use by the staging server.

19. The system as recited in claim 18, wherein a plurality of users in the one or more user groups can interact with the active server to access the secured electronic documents, and wherein an authorized administrator of the security system can interact with the staging server to test the staging environment prior to deploying the staging environment as the active environment by synchronizing the document access information stored in the database with the access information for use by the staging server.

20. The system as recited in claim 19, wherein the document access information is derived from the active document access information.

21. The system as recited in claim 18, wherein the database further includes at least revert document access information for storing at least one prior version of the active document access information.

22. The system as recited in claim 21, wherein at least one of the active document access information and the revert document access information are configured to include at least a plurality of partitions, each of the partitions pertaining to a different type of document access information.

23. The system as recited in claim 22, wherein the document access information is derived from a selection of at least one partition from the active document access information and at least one partition from the revert document access information.

24. The system as recited in claim 22, wherein each of the active document access information, the document access information and the revert document access information includes or references one or more of access rules or access policies.

25. A non-transitory computer readable storage medium having instructions stored thereon, the instructions comprising:

instructions to form access information for staging with respect to a security system, wherein the security system operates to restrict access to secured electronic data based on access information, and wherein the access information is based on active access information in use by the security system, wherein the access information includes or references one or more of access rules or access policies including at least when and where the secured electronic data can be accessed by a plurality of users, and wherein the active access information is stored in a database operatively connected to the security system;

instructions to alter the access information to modify the behavior of the security system during the staging; and

instructions to deploy the altered access information so as to synchronize the active access information stored in the database with the altered access information.

26. The non-transitory computer readable storage medium as recited in claim 25, wherein:

the security system thereafter operates in the manner as previously staged; and

the instructions to alter comprises modifying at least one of the access rules or at least one of the access policies of the access information to produce the altered access information.

27. The non-transitory computer readable storage medium as recited in claim 25, wherein the instructions further comprise:

instructions to test the behavior of the security system during the staging by operating the security system in accordance with the altered access information.

28. A non-transitory computer readable storage medium having instructions stored thereon, the instructions comprising:

initializing a staging server with initial access limitations derived from active access limitations, wherein a security system operates to restrict access to secured electronic data based on the access limitations, wherein the access limitations include or reference one or more of access rules or access policies including at least when and where the secured electronic data can be accessed by one or more users or user groups, and wherein the active access limitations are stored in a database operatively connected to the security system;

instructions for modifying the initial access limitations to provide a staged environment;

instructions for verifying operation of the security system in the staged environment while utilizing the modified access limitations; and

instructions for deploying-the staged environment as an active environment of the security system so as to synchronize the active access limitations stored in the database with the modified access limitations.

29. The non-transitory computer readable storage medium as recited in claim 28, wherein the deploying comprises:

archiving the access limitations of the security system; and

replacing the access limitations of the security system with the modified access limitations.

30. A non-transitory computer readable storage medium having instructions stored thereon, the instructions comprising:

instructions to obtain access information for staging with respect to a security system, wherein the security system operates to restrict access to secured electronic data based on access information, and wherein the access information includes or references one or more of access rules or access policies including at least when and where the secured electronic data can be accessed by a plurality of users, and wherein the active access is stored in a database operatively connected to the security system;

testing the behavior of the security system during the staging by operating the security system in accordance with the access information;

instructions to alter the access information to modify the behavior of the security system during the staging; and

instructions to deploy the access information to be used as the access information for normal operational use of the security system in restricting access to the secured electronic data so as to synchronize the active access information stored in the database with the altered access information.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,890,990 B1
APPLICATION NO. : 10/327320
DATED : February 15, 2011
INVENTOR(S) : Vainstein et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On Title Page 5, item (56), under "Other Publications", in Column 1, Line 50, delete ""Feature" and insert -- "Features --.

On Title Page 5, item (56), under "Other Publications", in Column 2, Line 35, delete "netwok"" and insert -- network" --.

On Title Page 6, item (56), under "Other Publications", in Column 2, Line 18, delete "Ciphertcxt,"" and insert -- Ciphertext," --.

Column 16, line 64, in Claim 28, delete "deploying-the" and insert -- deploying the --.

Signed and Sealed this
Twenty-eighth Day of June, 2011

David J. Kappos
Director of the United States Patent and Trademark Office